

## Technical Guidance Document #2

### Surveying Monitoring Wells

Many groundwater monitoring wells have been installed throughout the state for the investigation of petroleum releases from underground storage tank systems. These wells are important for determining water quality and the direction of groundwater flow. To accurately determine the direction of groundwater flow, monitoring wells must be surveyed to a common datum. This is especially important when the monitoring wells are installed in an urban area with other potential petroleum sources, or third parties that may be impacted by a release.

An initial survey of groundwater monitoring well elevations must be completed by a licensed surveyor or professional engineer registered in the State of Montana in accordance with Title 37, chapter 67, Montana Code Annotated.

The vertical control datum used to determine the elevation of the well must be the North American Vertical Datum of 1988 (NAVD 88), which should be referenced to a nearby United States Geological Survey (USGS), or equivalent, benchmark. NAVD 88 is the vertical control datum established in 1991 by the minimum-constraint adjustment of the Canadian-Mexican-U.S. leveling observations, <http://www.ngs.noaa.gov/faq.shtml#WhatVD29VD88>. NAVD 1988 is based on orthometric height. Informally, this could be considered as a height above mean sea level. The National Geodetic Survey (NGS) develops and maintains NAVD 88, <http://www.ngs.noaa.gov/faq.shtml#WhatDatum>. The NAVD 88 was affirmed as the official vertical datum for the United States by a notice in the Federal Register ([Vol. 58, No. 120](#), page 34325) on June 24, 1993. Deviations from this technical standard may be made on a case-by-case basis where another datum can be justified.

The Montana Department of Environmental Quality (DEQ) standard for determining latitude and longitude coordinates is the North American Datum of 1983 (NAD 83), which should also be referenced to a nearby USGS, or equivalent, horizontal control mark. NAD 83 is the horizontal control datum for the United States, Canada, Mexico and Central America, and is based on a geocentric origin and the *Geodetic Reference System 1980*, [http://www.ngs.noaa.gov/CORS-Proxy/Glossary/xml/NGS\\_Glossary.xml](http://www.ngs.noaa.gov/CORS-Proxy/Glossary/xml/NGS_Glossary.xml).

Montana Code Annotated for coordinates, Title 70. Property, Chapter 22. Corner Recordation Act Surveys and Coordinates, Part 2. Montana Coordinate System can be found at: [http://data.opi.mt.gov/bills/mca\\_toc/70\\_22\\_2.htm](http://data.opi.mt.gov/bills/mca_toc/70_22_2.htm)

Detailed information regarding NAVD 88 and NAD 83 is available from the NGS <http://www.ngs.noaa.gov/>.

The Global Positioning System (GPS) coordinate reference used by the DEQ is the World Geodetic System of 1984 (WGS 84). WGS 84 is not a valid coordinate system for North America, but must be referenced to NAD 83.

The survey of the monitoring wells must be accurate to the Fourth Order (0.10 feet x square root of total distance of level loop in miles) with a measurement precision of 0.01 feet (US Army Corps of Engineers Manual “Geodetic and Control Surveying”, <http://www.usace.army.mil/publications/eng-manuals/em1110-1-1004/c-3.pdf>).